PUNA GEOTHERMAL VENTURE

A Hawaii Partnership

June 1, 1993

Mr. Nolan Hirai
Clean Air Branch
State Department of Health
P.O. Box 3378
Honolulu, HI 96801

SUBJECT: CLEANOUT FLOW AND SAMPLING PROGRAM FOR WELL KS-10

Dear Nolan:

The planned cleanout flow of Well KS-10 will be done similarly in nearly all respects to the successful cleanout flow of KS-9 on April 20, 1993. The experience on KS-9 has prompted some minor revisions in the program for KS-10 submitted to your department on February 22, 1993. These revisions are as follows:

Page 1, Section 2.1

A more detailed version of the cleanout flow procedure in Section 2.1 has been written and is included as Appendix C.

Page 4, Section 3.2.1

After the onset of steam flow, sodium hydroxide solution will be injected downstream of the James tube instead of upstream, as stated in the plan. This will be done to avoid the possibility of silica scale deposition in the James tube. Abatement injection downstream of the James tube is conventional practice and yielded good abatement efficiency on KS-8. An abatement tap will be available upstream of the James tube if it is determined to be necessary for adequate abatement during the test.

Page 5, Section 3.3.1

As described in the program, the flowline will be monitored for abatement effectiveness until steam flow begins. In addition to monitoring liquid pH, as described in the plan, the gas phase will be monitored continuously for H_2S. An H_2S concentration of 100 ppm or greater will trigger an adjustment of well flow rate, an increase in sodium hydroxide injection, or shut-in of the well.

New Appendix D

Appendix D has been added for MSDS sheets on sodium hydroxide and hydrogen sulfide.

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Post Office Box 30, Pahoa, Hawaii 96778

The only material difference between the revised cleanout flow program for KS-10 and the procedure used successfully on KS-9 is the abatement injection point after steam flow begins. The reason for this is discussed above.

If you have any questions or need additional information in the course of your review, please call me.

Sincerely,

Thomas G. Kizis

Thomas G. Kizis
Environmental Manager

TGK/sls

cc: Steve Morris
Manabu Tagamori, DLNR

Memo: A:21560.TK
File: KS-9

APPENDIX C
DETAILED CLEANOUT FLOW PROCEDURE
Production Well KS-10
May 31, 1993

Facility Installation

1. Install facility as shown in Figure 1, including NaOH injection equipment. Install equipment for sampling emissions from atmospheric separator (Thermochem and Tecton).

2. Install electric and hydraulic valve actuators on wellhead master valves. Install remote handwheel on 10-inch wing valve. For electric valve actuator, install permanent wiring.

3. Install sample separators and Halliburton pumping equipment on the morning of the cleanout flow.

4. Clear the location of unnecessary equipment, and confirm escape routes to the north, south and west.

Pre-Flow Procedures

1. One or more days before the cleanout flow, conduct a meeting with personnel participating in the cleanout flow for a final review of equipment and procedures and coordination of operations. Principal topics will be personnel safety, H_2S abatement, responsibilities, communications, emergency procedures and responses.

2. On the day before the cleanout flow, sample fluid at wellhead and have Tecton analyze for H_2S concentration.

   a. If steam is present at the wellhead, proceed according to the approved Cleanout Flow and Sampling Plan.

   b. If condensate or gas (other than steam) is present, plan to inject NaOH solution upstream and downstream of the 2-inch throttle valve until the onset of steam-dominated flow. Plan the initial well flow rate and NaOH injection rate to provide a 4:1 mole ratio of NaOH to H_2S at the wellhead or immediately downstream in the flow line.

3. Make final determination of abatement dosage. In the absence of information to the contrary, initial dosage will be based on an assumption of gas-saturated condensate in the wellbore at a maximum expected flow rate of 100,000 lb/hr. On this basis, initial injection rates of NaOH will be as follows:

   Upstream of 2-inch Throttle Valve: Using Halliburton pumper, pump 0.3 BPM of 50% NaOH and blend with 0.3 BPM water for 4:1

mole ratio.

Downstream of 2-inch Throttle Valve: Inject approximately 400 gph of 50% NaOH as partial redundancy for injection near wellhead.

Downstream of James Tube Discharge: Inject approximately 400 gph of 50% NaOH as partial redundancy for injection near wellhead. Inject water as shown in Figure 1 using another Halliburton pump truck. Tecton will specify flow rate.

4. The drilling operations safety consultant will establish locations for briefing stations and SCBA's and red flag the location.

5. Install two frac tanks and water supply, and fill frac tanks. Rig up kill line and Halliburton pump truck.

6. On the day of the cleanout flow, Tecton will install a stationary H_2S monitor with strobe light warning set at 10 ppm and audible alarm set at 20 ppm concentrations. The two sensors will be placed in the immediate area of the wellhead and piping where critical personnel are located.

7. On the day of the cleanout flow, hold a safety meeting on location with all personnel to be involved in the operation. The following topics will be covered:

   a. Overview of cleanout flow program, facility layout and flow diagram, expected conditions and contingency planning;

   b. Review of the safety procedures list including emergency roles and responsibilities and final check of location and wind conditions;

   c. Review of site map, egress routes for personnel on location, traffic control points, and locations for other personnel;

   d. Communications and signaling procedures for control of well flow, emergencies, and putting on SCBA's; and

   e. Locations of Briefing Stations and spare SCBA's.

   f. Review of applicable MSDS information and safety equipment.

8. Perform radio check and give 20-minute notice of startup to CSC. CSC will notify HDOH and HCD and confirm contacts. Verify radio contact with the rescue team, traffic control on the approach road to Pad A and ambient air monitoring technicians.

9. Clear Pad A of all but the following essential personnel:

   a. Test Operations Supervisor

   b. Safety Supervisor

   c. Well field operators (2)

   d. Tecton Abatement Operators (2)

   e. Halliburton Pump Truck Operators for wellhead abatement (2)

   f. Test Engineer

   g. Chemists to monitor flow line sampling ports (2)

   Other personnel, except traffic control, monitoring technicians and perimeter security, will go to the power plant/office area.

10. Check wind direction and velocity. Relocate off-site personnel, if necessary, to be out of the downwind area.

11. Position valves as follows:

    Vent valve on 20-inch X 13⅜-inch annulus - open
    Casinghead vent valve - Open (vent line to muffler inlet)
    Kill line valve on wellhead - open
    2-inch throttle valve - Closed
    10-inch throttle valve - Closed
    Lower master valve - Open
    Upper master valve - Open
    10-inch wing valve - Open

Startup and Flow Procedure

1. Make final notification to CSC. CSC will notify HDOH and HCD.

2. Before opening the well to flow, be prepared to monitor continuously for H_2S concentration and water pH at the sample separator on the 10-inch flow line.

3. At least one minute before opening the 2-inch throttle valve, begin injection of NaOH solution at all three injection points shown in the attached diagram.

4. Each person on Pad A during the startup on will carry an SCBA, ready to don the mask, as a precautionary measure. The Safety Supervisor will verify that everyone is carrying breathing apparatus and will signal Test Operations Supervisor to proceed with initiating flow.

5. Open the 2-inch throttling valve to establish an estimated net well flow rate of no more than 100,000 lb/hr of condensate or steam, or no more than about 50,000 lb/hr of nitrogen. Begin continuous monitoring at the sample separator. Reduce flow rate if necessary to keep pressure downstream of throttle valve at 80 psig or less.

6. For the monitor at the sample separator, real-time measurement of the water pH and H_2S concentrations in the gas phase will be the early-warning indicators of the abatement effectiveness. A pH less than 12.0 or H_2S readings above 100 ppm will trigger an adjustment of well flow rate, an increase in NaOH injection, or shut-in of the well. The Chemist and Test Operations Supervisor will decide what corrective action to take based on the degree to which the measurements exceed the above criteria.

7. Ambient H_2S concentrations on Pad A will be monitored by the Safety Supervisor using a Gas Tec sampler and by a stationary monitoring instrument with two sensors located in the immediate area of the wellhead and piping where critical personnel are located. If there is any verified reading of greater than 20 ppm, the well will be shut in, and corrective steps will be taken before resuming flow. Although personnel on Pad A will carry breathing apparatus and would not be at risk with higher ambient concentrations, the 20 ppm limit is established for the unlikely event that unauthorized personnel could breach security and enter the area without proper training or breathing apparatus.

8. As soon as a strong steam flow is established:

   a. Shut off the flow line sample separator until needed for normal sampling activities.

   b. Verify that water and NaOH solution (50% solution at about 380 gph or more) are being injected in the normal abatement ports downstream of James Tube discharge.

   c. After verification of downstream abatement, shut off injection of NaOH downstream of the 2-inch throttle valve, close injection port valve, disconnect hose, and immediately reconnect hose from abatement Unit B to backup abatement port on 20-inch line downstream of James Tube.

   d. As soon as Step 8c is completed, shut down injection of NaOH by Halliburton and close injection port valve.

   e. As soon as Safety Supervisor confirms that ambient H_2S levels on Pad A are sufficiently low, he will issue orders for additional necessary personnel to come to Pad A.

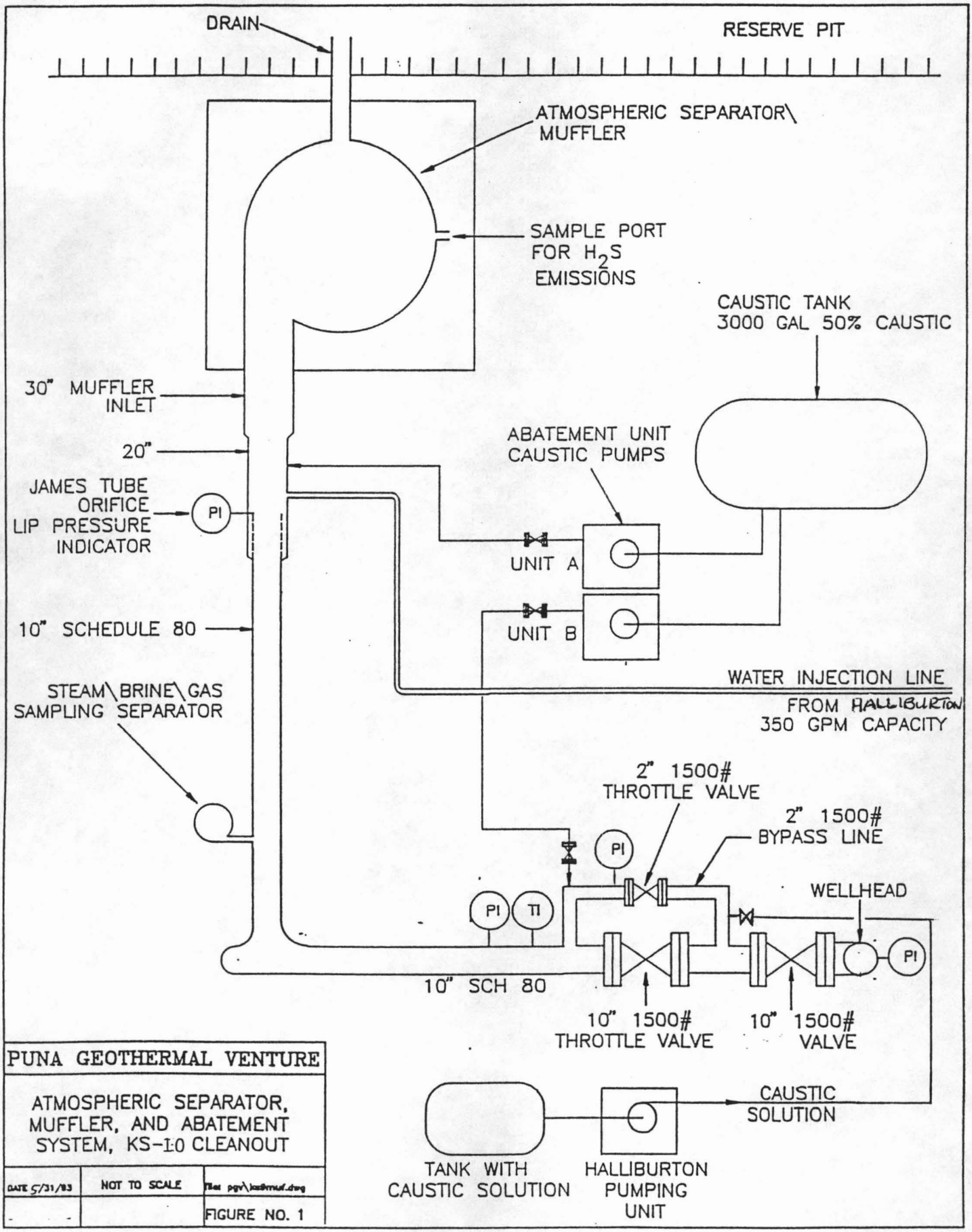
f. As soon as possible, Tecton will sample steam from the atmospheric separator, analyze for H_2S and calculate mass rate of emission. Test Engineer will provide flow rate data for this determination.

   If necessary, make process adjustments to maintain H_2S emissions within the permitted 5 lb/hr limit or to avoid excessive carryover of liquid droplets from atmospheric separator.

g. After approximately 30 minutes of steam-dominated flow, notify CSC by radio, shut in well if necessary and retighten wellhead flange bolts. Reconnect Tecton Unit B for abatement downstream of the throttle valve.

h. When ready to resume flow, notify CSC. (CSC will notify HDOH and HCD.) Restart in accordance with steps 2 - 8f of startup and flow procedure.

i. Continue the cleanout for a period of up to 3 more hours, following the approved Cleanout Flow and Sampling Program. Chemist taking unabated gas samples will mask up when sampling.



PUNA GEOTHERMAL VENTURE		
ATMOSPHERIC SEPARATOR, MUFFLER, AND ABATEMENT SYSTEM, KS-10 CLEANOUT		
DATE 5/31/83	NOT TO SCALE	file: pgv\ks8muf.dwg
		FIGURE NO. 1

APPENDIX D

MSDS SHEETS

OxyChem®

MATERIAL SAFETY DATA SHEET

MSDS NUMBER : M4806

MSDS DATE : 03-30-92

PRODUCT NAME : 50% CAUSTIC SODA-DIAPHRAGM

24 HOUR EMERGENCY PHONE: 1-800-733-3665

I. PRODUCT IDENTIFICATION

HMIS HAZARD RATINGS

HEALTH HAZARD 3 **FIRE HAZARD 0** **REACTIVITY 2**

Based on the National Paint & Coatings Association HMIS rating system.

SARA/TITLE III HAZARD CATEGORIES (See Section X)

Immediate (ACUTE) Health: YES
Delayed (Chronic) Health: NO
Fire Hazard: NO
Reactive Hazard: YES
Sudden Release of Pressure: NO

MANUFACTURER'S NAME AND ADDRESS: Occidental Chemical Corporation
Customer Service, Occidental Tower,
P O Box 809050, Dallas, Texas 75380
Telephone (1-800-752-5151)

CHEMICAL NAME: Sodium Hydroxide CAS NUMBER: 1310-73-2

SYNONYMS/COMMON NAMES: Sodium Hydroxide; NaOH

CHEMICAL FORMULA: NaOH

DOT PROPER SHIPPING NAME: Sodium Hydroxide, Liquid

DOT HAZARD CLASS: Corrosive Material

DOT I.D. NUMBER: UN1824

DOT HAZARDOUS SUBSTANCE: RQ 1000#

II. HEALTH HAZARD INFORMATION

EMERGENCY AND FIRST AID PROCEDURES

EYES:

OBJECT IS TO FLUSH MATERIAL OUT IMMEDIATELY THEN SEEK MEDICAL ATTENTION, IMMEDIATELY flush eyes with large amounts of water for at least 15 minutes forcibly holding lids apart to ensure flushing of entire surface. Washing eyes within several seconds is essential to achieve maximum effectiveness. SEEK MEDICAL ATTENTION IMMEDIATELY.

CONTINUED ON NEXT PAGE

CAS = Chemical Abstract Service Number ND = No relevant information found or not available
PEL = OSHA Permissible Exposure Limit CORP = Corporate Exposure Limit
TLV = ACGIH Threshold Limit Value, Current * = See Chronic Effects Information NA = Not applicable

II. HEALTH HAZARD INFORMATION (Continued)

SKIN:

IMMEDIATELY wash with plenty of water for at least 15 minutes. Remove contaminated clothing and footwear. Wash clothing before reuse and discard footwear which cannot be decontaminated. SEEK MEDICAL ATTENTION IMMEDIATELY.

INHALATION:

Remove to fresh air; if breathing is difficult have trained person administer oxygen. If respiration stops, give mouth-to-mouth resuscitation. GET MEDICAL ATTENTION.

INGESTION:

NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. If available, give several glasses of milk. If vomiting occurs spontaneously, keep airway clear. SEEK MEDICAL ATTENTION IMMEDIATELY.

ROUTES OF EXPOSURE

INHALATION:

Airborne concentrations of dust, mist, or spray of this product may cause damage to the upper respiratory tract and lung tissue proper which could produce chemical pneumonia, depending upon severity of exposure.

SKIN:

This product is destructive to tissue contacted and produces severe burns. A latent period may exist between exposure and sense of irritation.

EYE CONTACT:

This product is destructive to eye tissues on contact. Will cause severe burns that result in damage to the eyes and even blindness.

INGESTION:

This product, if swallowed, can cause severe burns and complete tissue perforation of mucous membranes of the mouth, throat, esophagus, and stomach.

EFFECTS OF OVEREXPOSURE

ACUTE:

Corrosive to all body tissues with which it comes in contact. The effect of local dermal exposure may consist of multiple areas of superficial destruction of the skin or of primary irritant dermatitis. Similarly, inhalation of dust, spray, or mist may result in varying degrees of irritation or damage to the respiratory tract tissues and an increased susceptibility to respiratory illness. These effects occur only when the TLV is exceeded.

CHRONIC:

No known chronic effects.

TOXICOLOGY DATA:

Caustic soda is a corrosive material.
Acute Dermal LD50 (rabbit) 1350 mg/kg

Human Dermal Exposure

Regardless of concentrations, the severity of damage and extent of its irreversibility increases with length of contact time. Prolonged contact with even dilute sodium hydroxide solution can cause a high degree of tissue destruction. The latent period, following skin contact during which no sensation of irritation occurs, varies from several hours for 0.4 - 4% solution to 3 minutes with 25 - 50% solution.

III. IMPORTANT COMPONENTS

CAS NUMBER / NAME
1310732 Sodium hydroxide (Na(OH))

EXPOSURE LIMITS
PEL=2 mg/m3, Ceiling
TLV=2 mg/m3, Ceiling

PERCENTAGE
VOL 31.90
WT 50

COMMON NAMES:
CAUSTIC SODA

Listed On(List Legend Below):
13 18 21

7732185

EXPOSURE LIMITS
PEL=Not Establis.
TLV=Not Established

PERCENTAGE
VOL 68.10
WT 50

COMMON NAMES:

Listed On(List Legend Below):
19 23

See Section II
All components of this product that are required to be on the TSCA Inventory are listed on the inventory.
Not listed as carcinogen - IARC, NTP, OSHA

LIST LEGEND
13 [illegible] ENVIROMENTAL HAZ SUBSTANCE
19 [illegible] REQUIREMENT- 3% OR GREATER
23 [illegible] EQUIREMENT- 1% OR GREATER
18 NY HAZARDOUS SUBSTANCES
21 NJ SPECIAL HEALTH HAZ SUB

IV. FIRE AND EXPLOSION DATA

FLASH POINT: NA AUTOIGNITION TEMPERATURE: Nonflammable

FLAMMABLE LIMITS IN AIR, % BY VOLUME- UPPER: NA
LOWER: NA

EXTINGUISHING MEDIA:
This product is not combustible. Water spray, foam, carb... dioxide or dry chemical may be used where this product is stored.

SPECIAL FIRE FIGHTING PROCEDURES:
Wear full protective clothing. Avoid direct contact of this product with water as this can cause a violent exothermic reaction.

UNUSUAL FIRE AND EXPLOSION HAZARD:
None. See Reactivity (Section VII).

V. SPECIAL PROTECTION

VENTILATION REQUIREMENTS:

Special ventilation is not required under normal use. Use local exhaust ventilation where dust, mist, or spray may be generated. NOTE: Where carbon monoxide or other reaction products may be generated, special ventilation may be required.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RATORY:

spiratory protection is not required under normal use. Use SH/MSHA approved respirators where dust, mist, or spray may be erated.

EYE:

Wear chemical safety goggles plus full face shield to protect against splashing.

GLOVES:

Chemical resistant gloves should be worn. Gloves may be decontaminated by washing with mild soap and water Natural and butyl rubber have been suggested.

OTHER CLOTHING AND EQUIPMENT:

Impervious protective clothing and chemically resista shoes should be worn to minimize contact. Wash contam clothing with soap and water and dry before reuse. St eyewash facilities should be accessible.

MONITORING EXPOSURE

BIOLOGICAL:

NA

PERSONAL/AREA:

Use NIOSH Analytical Method No. 7401.

VI. PHYSICAL DATA

BOILING POINT @ 760 mm Hg: 143°C (289°F)

FREEZING POINT: 12.1°C (54°F)

VAPOR PRESSURE: 13 mm Hg @ 60°C

SPECIFIC GRAVITY (H_2O=1): 1.54 @ 15.6°C

SOLUBILITY IN H_2O % BY WT: Completely soluble

VAPOR DENSITY (Air=1): NA

APPEARANCE AND ODOR: Clear liquid with no distinct odor.

pH: 7.5% solution has pH 14.0

DENSITY: 12.8 lb/gal

VII. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY:

Under normal conditions, this product is stable.

INCOMPATIBILITY:

See Handling and Storage (Section VIII). Avoid direct contact with water. This product may be added slowly to water or acids with dilution and agitation to avoid a violent exothermic reaction. When handling this product, avoid contact with aluminum, tin, zinc, and alloys containing these metals. Do not mix with strong acids without dilution and agitation to prevent violent or explosive reaction. Avoid contact with leather, wool, acids, organic halogen compounds and organic nitro compounds.

HAZARDOUS DECOMPOSITION PRODUCTS:

None known.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION:

Material is not known to polymerize.

VIII. HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS:

Do not get into eyes, on skin, on clothing.
Avoid breathing dust, mists, or spray.
Do not take internally.
Use with adequate ventilation and employ respiratory protection when exposure to dust, mist or spray is possible.
When handling, wear chemical splash goggles, face shield, rubber gloves and protective clothing.
Wash thoroughly after handling or contact - exposure can cause burns which are not immediately painful or visible.
Keep container closed.
Product can react violently with water, acids, and other substances - read Special Mixing and Handling Instructions below carefully before using.
Product is corrosive to tin, aluminum, zinc and alloys containing these metals, and will react violently with these metals in powder form.
Hazardous carbon monoxide gas can form upon contact with food and beverage products in enclosed spaces and can cause death. Follow appropriate tank entry procedures (ANSI Z117.1-1977).

SPECIAL MIXING AND HANDLING INSTRUCTIONS

Product can react violently with water. Considerable heat is generated when product is mixed with water. Therefore, when making solutions always carefully follow these steps:

ALWAYS wear ALL protective clothing described above. NEVER add water to product. ALWAYS add product - with constant stirring - slowly to surface of lukewarm (80-100°F) water, to assure product is being completely dissolved as it is added.

If product is added too rapidly, or without stirring, and becomes concentrated at bottom of mixing vessel, excessive heat may be generated, resulting in DANGEROUS boiling and spattering, and a possible IMMEDIATE AND VIOLENT ERUPTION of highly caustic solution.

VIII. HANDLING AND STORAGE (Continued)

SPECIAL MIXING AND HANDLING INSTRUCTIONS (Continued)

NOTE: Never add more product than can be absorbed by solution while maintaining temperature below 200°F (@ sea level) to prevent boiling and spattering.

Product can react EXPLOSIVELY with acids, aldehydes, and many other organic chemicals - when mixing product with solutions containing such chemicals, follow all of above mixing instructions, and add product very gradually, while stirring constantly.

ALWAYS empty and clean containers of all residues before adding product, to avoid possible EXPLOSIVE reaction between product and unknown residue.

Returnable containers should be shipped in accordance with supplier's recommendations. Return shipments should comply with all federal, state, and DOT regulations. All residual caustic soda should be removed from containers prior to disposal.

IX. ENVIRONMENTAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

Leaks should be stopped. Spills should be contained and cleaned up immediately. Spills should be removed by using a vacuum truck. Neutralize remaining traces of material with any dilute inorganic acid such as hydrochloric, sulfuric, nitric, phosphoric, and acetic acid. The spill area should then be flushed with water followed by liberal covering of sodium bicarbonate. All clean-up material should be removed and placed in approved containers, labeled and stored in a safe place to await proper treatment or disposal. Spills on areas other than pavement, e.g., dirt or sand, may be handled by removing the affected soils and placing in approved containers. Persons performing clean-up work should wear adequate personal protective equipment and clothing. Spills or releases should be reported, if required, to the appropriate local, state and federal regulatory agencies.

CAUTION. Caustic soda may react violently with acids and water.

WASTE DISPOSAL METHOD:

The materials resulting from clean-up operations may be hazardous wastes and, therefore, subject to specific regulations. Package, store, transport, and dispose of all clean-up materials and any contaminated equipment in accordance with all applicable federal, state, and local health and environmental regulations. Shipments of waste materials may be subject to manifesting requirements per applicable regulations. Appropriate disposal will depend on the nature of each waste material and should be performed by competent and properly permitted contractors. Ensure that all responsible federal, state, and local agencies receive proper notification of spill and disposal methods.

X. ADDITIONAL INFORMATION

OSHA Standard 29CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, material safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Material Safety Data Sheet available to your employees.

To aid our customers in complying with regulatory requirements, SARA Title III hazard categories for this product are indicated in Section I. If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR Part 370. Please consult those regulations for details.

XI. PREPARATION INFORMATION

For additional Non-Emergency health, safety, or environmental information telephone (716) 286-3081, or write to:

Occidental Chemical Corporation
Product Stewardship Department
Suite 400
360 Rainbow Boulevard South
Niagara Falls, NY 14302

For Emergencies: 24 HOUR EMERGENCY PHONE: 1-800-733-3665

This MSDS replaces MSDS Number M4806 dated 04-09-90.

7783064

SECTION I - MATERIAL IDENTIFICATION

CHEMICAL NAME: Hydrogen Sulfide

CHEMICAL FORMULA: H_2S

CHEMICAL FAMILY: Inorganic Acid

DATE PREPARED: 12/5/90

SUPPLIER: Scott Specialty Gases

ADDRESS: Route 611 Plumsteadville, PA 18949

In Case of Emergency, Contact your Regional Plant Manager

OTHER DESIGNATIONS: Dihydrogen sulfide, hydrosulfuric acid, sulfuretted hydrogen, CAS NO: 7783-06-4

SECTION II - HAZARDOUS INGREDIENTS

		EXPOSURE LIMITS (PPM)		
		ACGIH	OSHA	
COMPONENT	CONCENTRATION	TLV	PEL	OTHER
Hydrogen Sulfide	99+%	10	20 (C)	

SECTION III - PHYSICAL DATA

BOILING POINT (°F): -76.6

SPECIFIC GRAVITY (H_2O = 1) @ -60.3°C: 0.960

VAPOR PRESSURE @ 20°C: 18.15 atm

PERCENT, VOLATILE BY VOLUME (%): 100

VAPOR DENSITY (AIR = 1) @ 25°C: 1.19

EVAPORATION RATE (_____ = 1): N/A

SOLUBILITY IN WATER 0°C: 2.26 ml/ 1 ml of H_2O

APPEARANCE AND ODOR: Colorless gas with an offensive, rotten egg odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT AND METHOD	FLAMMABLE LIMITS	LEL	UEL
-60°C	Vol. %	4.3%	46%

EXTINGUISHING MEDIA: CO_2, dry chemical. The only safe way to extinguish a H_2S fire is to stop the flow of gas.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self-contained breathing apparatus and full protective clothing. Use water spray to keep fire exposed cylinders cool. Try to stop flow of gas. Otherwise, let the fire burn itself out.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapor may travel considerable distance to source of ignition and flash back. Emits toxic fumes under fire conditions. Cylinders exposed to fire may explode. Fight fire from maximum possible distance.

SECTION V - REACTIVITY DATA

STABILITY: Stable under normal storage conditions

INCOMPATIBILITY (MATERIALS TO AVOID): Oxidizing materials, rubber, lead, silver, alkali metals, mercury, brass, copper.

HAZARDOUS DECOMPOSITION PRODUCTS: Sulfur oxides

HAZARDOUS POLYMERIZATION: Will not occur

SECTION VI - HEALTH HAZARD DATA

ROUTES OF ENTRY: Inhalation

EFFECTS OF OVER EXPOSURE (ACUTE): Irritation to the eyes, mucous membranes, and upper respiratory tract. May cause pulmonary edema, headache, dizziness, bronchitis, and respiratory paralysis. High concentrations may cause collapse and death. (CHRONIC): May cause conjunctivitis, photophobia, corneal bullae, tearing, pain and blurred vision. (MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE): Persons with impaired pulmonary function or pre-existing eye problems may be at increased risk from exposure.

CARCINOGENICITY - NTP? NO IARC MONOGRAPHS? NO OSHA REGULATED? NO

EMERGENCY AND FIRST AID: Inhalation - Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. Skin/Eye contact - Immediately flush with copious amounts of water for at least 15 minutes while removing contaminated clothing. Contact a physician.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN: Evacuate and ventilate area. Remove sources of ignition. Wear protective equipment. Remove leaking cylinder to exhaust hood or safe outdoors area if this can be done safely.

WASTE DISPOSAL METHOD: Return cylinders to supplier for proper disposal with any valve outlet plugs or caps secured and valve protection cap in place.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE): Use a self-contained breathing apparatus in case of emergency or non-routine use.

VENTILATION: Provide adequate and local exhaust ventilation to maintain concentration below exposure limits.

OTHER PROTECTIVE EQUIPMENT: Wear safety glasses and safety shoes when handling cylinders.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Store in well ventilated areas only. Keep valve protection cap on cylinders when not in use and secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders.

OTHER PRECAUTIONS: Do not deface cylinders or labels. Move cylinder with adequate hand truck. Cylinders should be refilled by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with this written consent is a violation of federal law (49 CFR).

I(01,14)II(01,14,16)III-VII(01,14)VIII(01)IX(01,14)